

WIRELESS ACCESS CONTROL METHOD AND WIRELESS ACCESS SYSTEM

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a wireless access control
5 method and a wireless access system.

Description of the Related Art

In recent years, as the Internet has become widespread, a wireless access system for access from a mobile terminal to the Internet has been contemplated.

10 A conventional wireless access system is described below. Among other wireless access systems, a wireless LAN system using a wireless LAN (local area network) as a wireless transmission line is described herein.

By referring to FIG. 5, the wireless LAN system according
15 to the conventional technology includes a mobile terminal 100, a wireless base station 200 for communicating with the mobile terminal 100 through a wireless line, an access network control station 300 for controlling the communications with the mobile terminal 100 through a wireless access network, and a wireless access gateway (default router) 400 for establishing a channel
20 between the mobile terminal 100 and equipment external to the wireless access network.

The operation performed as an operation of the conventional wireless LAN system shown in FIG. 5 when the communications is
25 performed from the mobile terminal 100 to equipment external

to the wireless access network is described below by referring to a flowchart shown in FIG. 6.

A wireless transmission line (802.11 association) in the wireless LAN is established between the mobile terminal 100 and the wireless base station 200 (step 700). "802.11" refers to a standard of a wireless LAN standardized by the IEEE 802 Committee, and 2.4 GHz band DS (direct spread), FH (frequency hopping) system, etc. is prescribed.

Then, the wireless base station 200 transmits an 802.1X authentication request signal for authenticating access by the mobile terminal 100 (step 710). In this example, "802.1X" refers to a standard of an authentication protocol standardized by the IEEE 802 Committee, and is used in user authentication, etc. during logging in a wireless LAN.

15 The mobile terminal 100 returns to the wireless base station 200 an 802.1X authentication reply signal corresponding to an 802.1X authentication request signal received from the wireless base station 200 (step 720).

The wireless base station 200 converts the 802.1X authentication reply signal which is a wireless region specific signal received from the mobile terminal 100 into a RADIUS authentication signal which is an IP (Internet protocol) layer signal (step 730), and transmits the converted RADIUS authentication signal as a RADIUS authentication reply signal to the access network control station 300 (step 740). "RADIUS" refers to the standard (RFC 2138) of the user authentication system standardized by the IETF, and is used when access is permitted or rejected, etc. according to user information.

The access network control station 300 determines whether or not access by the mobile terminal 100 is permitted according to the RADIUS authentication reply signal received from the wireless base station 200. When access is permitted, a RADIUS 5 authentication permission signal is transmitted to the wireless base station 200 (step 750).

The wireless base station 200 converts a RADIUS authentication permission signal which is an IP layer signal into an 802.1X authentication permission signal which is a 10 wireless specific signal (step 760), and the converted 802.1X authentication permission signal is transmitted to the mobile terminal 100 (step 770).

Then, the mobile terminal 100 starts communications with a terminal external to the wireless access network (step 780).

15 As described above, in access control shown in FIG. 6 the conventional wireless access system realizes access control to equipment external to the wireless access network by converting a wireless region specific signal into an IP layer signal by the wireless base station. On the other hand, the technology 20 of the IP layer has been advanced through the standardization by the IETF, etc., and technologies of authentication, accounting, QoS (Quality of Service) control, etc. have been newly developed.

In the conventional wireless access system, the IP layer 25 technology can be applied to a wireless access network if a new IP layer technology is added or amended to a wireless region specific signal in the processes in steps 700 to 720 in the wireless base station.

However, after completing the access control process, the processes in steps 700 to 720 are not performed. Therefore, unless a new IP layer technology is added or amended to the wireless region specific signal before completing the access control 5 process in the wireless base station, all IP packets received and put in packets by the wireless base station are transmitted outside the wireless access network without applying a new IP layer technology.

The present invention aims at providing a wireless access 10 control method and a wireless access system in which a new IP layer technology can be applied to a wireless access network without a wireless base station adding or amending the new IP layer technology to a wireless region specific signal.

SUMMARY OF THE INVENTION

15 To attain the above-mentioned object, the wireless access control method according to the present invention uses a mobile terminal, a wireless base station for communications with the mobile terminal through a wireless channel, an access network control station for control of a wireless access network by 20 communications with the mobile terminal, and a wireless access gateway for establishing a channel between the mobile terminal and the equipment external to the wireless access network. With the above-mentioned configuration, the method includes the steps of: the mobile terminal transmitting to the wireless base station 25 a wireless control signal to be transmitted to equipment external to the wireless access network; the wireless base station transferring the wireless control signal to the wireless access

gateway without converting the signal; when the wireless control signal is transferred from the wireless access gateway, the access network control station communicating with the mobile terminal through the wireless base station, and determining whether or

5 not communications with equipment external to the wireless access network of the mobile terminal is allowed based on the communications between the station and the mobile terminal; when the access network control station allows the communications of the mobile terminal with the equipment external to the wireless

10 access network, the access network control station instructing the wireless access gateway to establish a channel between the mobile terminal and the wireless access network; and upon receipt of the instruction from the access network control station to establish a channel between the mobile terminal and the equipment

15 external to the wireless access network, the wireless access gateway establishing the channel between the mobile terminal and the equipment external to the wireless access network, and transmitting the wireless control signal to the equipment external to the wireless access network.

20 With the above-mentioned configuration, the access network control station can apply a new IP layer technology to a wireless access network during communications with a mobile terminal. Therefore, it is not necessary for the wireless base station to add or amend the new IP layer to a wireless region specific

25 signal.

The method can also be designed such that, when the wireless access gateway establishes a channel between the mobile terminal and the equipment external to the wireless access network, the

wireless access gateway can instruct the wireless base station to establish a dedicated channel between the mobile terminal and the wireless access gateway in a wireless region.

The method can also be designed such that, when the wireless control signal is transferred from the wireless base station, and when the wireless access gateway determines that a source of the wireless control signal is not allowed to communicate with equipment external to the wireless access network, the wireless access gateway can change the destination of the wireless control signal to the access network control station, and transfer the wireless control signal to the access network control station.

The method can also be designed such that, when the wireless control signal is transferred from the wireless base station, and when the wireless access gateway determines that a source of the wireless control signal is allowed to communicate with equipment external to the wireless access network, the wireless access gateway does not change the destination of the wireless control signal to the access network control station, but establishes a channel between the mobile terminal and equipment external to the wireless access network, and transmits the wireless control signal to the equipment external to the wireless access network.

The method can also be designed such that, when the wireless control signal is transferred from the wireless base station, and when the wireless access gateway determines that a shared control channel different from the dedicated channel is used in communications of the wireless control signal, the wireless access gateway can change the destination of the wireless control

signal into the access network control station, and transfer the wireless control signal into the access network control station.

The method can also be designed such that, when the wireless control signal is transferred from the wireless base station, and when the wireless access gateway determines that the dedicated channel is used in communications of the wireless control signal, the wireless access gateway does not change the destination of the wireless control signal into the access network control station, but establishes a channel between the mobile terminal and equipment external to the wireless access network, and transmits the wireless control signal to the equipment external to the wireless access network.

To attain the above-mentioned object, the a wireless access system according to the present invention includes: a mobile terminal for transmitting a wireless control signal to be transmitted to equipment external to the wireless access network; a wireless base station for transferring the wireless control signal from the mobile terminal without conversion; a wireless access gateway for further transferring the wireless control signal when the wireless control signal is transferred from the wireless base station, and when it is determined that a source of the wireless control signal is not allowed to communicate with equipment external to the wireless access network; and an access network control station for instructing the wireless access gateway to establish a channel between the mobile terminal and equipment external to the wireless access network when communications are performed with the mobile terminal through

the wireless base station when the wireless control signal is transferred from the wireless access gateway, and when communications between the mobile terminal and equipment external to the wireless access network is allowed based on the 5 communications performed with the mobile terminal. With the above-mentioned configuration, when the wireless access gateway is instructed to establish a channel between the mobile terminal and equipment external to the wireless access network by the access network control station, the wireless access gateway 10 establishes a channel between the mobile terminal and the equipment external to the wireless access network, and transmits the wireless control signal to the equipment external to the wireless access network.

To attain the above-mentioned object, another aspect of 15 the wireless access system according to the present invention includes; a mobile terminal for transmitting a wireless control signal to be transmitted to equipment external to the wireless access network; a wireless base station for transferring the wireless control signal from the mobile terminal without 20 conversion; a wireless access gateway for further transferring the wireless control signal depending on a channel used in communications of the wireless control signal when the wireless control signal is transferred from the wireless base station; and an access network control station for instructing the wireless 25 access gateway to establish a channel between the mobile terminal and equipment external to the wireless access network when communications are performed with the mobile terminal through the wireless base station when the wireless control signal is

transferred from the wireless access gateway, and when
communications between the mobile terminal and equipment
external to the wireless access network is allowed based on the
communications performed with the mobile terminal. With the
5 above-mentioned configuration, when the wireless access gateway
is instructed to establish a channel between the mobile terminal
and equipment external to the wireless access network by the
access network control station, the wireless access gateway
establishes a channel between the mobile terminal and the
10 equipment external to the wireless access network, and transmits
the wireless control signal to the equipment external to the
wireless access network.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of a wireless access system
15 according to the first embodiment of the present invention;

FIG. 2 is a flowchart of the operations of the wireless
access system shown in FIG. 1;

FIG. 3 is a block diagram of a wireless access system
according to the second embodiment of the present invention;
20 FIG. 4 is a flowchart of the operations of the wireless
access system shown in FIG. 3;

FIG. 5 is a block diagram of the conventional wireless access
system; and

FIG. 6 is a flowchart of the operation of the wireless access
25 system shown in FIG. 5.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The embodiments of the present invention are described below by referring to the attached drawings.

(First Embodiment)

FIG. 1 is a block diagram of the wireless access system
5 according to the first embodiment of the present invention.

As shown in FIG. 1, the wireless access system according to the first embodiment of the present invention comprises the mobile terminal 100, the wireless base station 200 for communications with the mobile terminal 100 through a wireless
10 circuit, the access network control station 300 for control of the communications between the mobile terminal 100 and a wireless access network, and the wireless access gateway 400 (default router) for establishing a channel between the mobile terminal 100 and equipment external to the wireless access network.

15 The wireless access gateway 400 comprises an intra-network signal transmission/reception device 401, a source discrimination device 402, a destination change device 403, a channel control device 404, and a channel establishment device 405.

20 The intra-network signal transmission/reception device 401 transmits/receives a signal between the wireless base station 200 and the access network control station 300 in the wireless access network.

The source discrimination device 402 determines whether
25 or not the source of the wireless control signal received by the intra-network signal transmission/reception device 401 is permitted to communicate with equipment external to the wireless access network.

When the source discrimination device 402 determines that the source of the wireless control signal is not permitted to communicate with equipment external to the wireless access network, the destination change device 403 changes the

5 destination of the wireless control signal received by the intra-network signal transmission/reception device 401 into the access network control station 300.

When the access network control station 300 permits the communications between the mobile terminal 100 and equipment
10 external to the wireless access network, the channel control device 404 controls the establishment of a channel between the mobile terminal 100 and the equipment external to the wireless access network.

The channel establishment device 405 establishes a channel
15 between the mobile terminal 100 and the equipment external to the wireless access network under control of the channel control device 404.

The operations performed by the wireless access system shown in FIG. 1 in the communications from the mobile terminal 100
20 to a terminal external to the wireless access network are described below by referring to a flowchart shown in FIG. 2.

First, the mobile terminal 100 transmits a communications establishment request signal which is a wireless control signal to the wireless base station 200, and the wireless base station
25 200 transfers the communications establishment request signal to the wireless access gateway 400 without conversion (step 500).

In the wireless access gateway 400, the intra-network signal transmission/reception device 401 receives the communications

establishment request signal from the mobile terminal 100, and the source discrimination device 402 determines whether or not the source of the communications establishment request signal, that is, the mobile terminal 100, is permitted to communicate 5 with equipment external to the wireless access network. If the mobile terminal 100 is not permitted to communicate with the equipment external to the wireless access network, the destination change device 403 changes the destination of the communications establishment request signal into the access network control 10 station 300 (step 510), and the intra-network signal transmission/reception device 401 transfers the communications establishment request signal to the access network control station 300 (step 520).

Then, access network control station 300 continues through 15 the wireless base station 200 the communications with the mobile terminal 100 which is the source of the communications establishment signal transferred from the wireless access gateway 400. In the communications, if a new IP layer technology has been developed, the IP layer technology is applied to the 20 wireless access network.

Then, the access network control station 300 determines whether or not the mobile terminal 100 is to be permitted to communicate with equipment external to the wireless access network based on the communications with the mobile terminal 25 100. If the communications with the equipment external to the wireless access network is to be permitted, then the access network control station 300 transmits a communications establishment permission signal to the wireless access gateway 400 (step 530).

In the wireless access gateway 400, the channel control device 404 receives a communications establishment permission signal from the access network control station 300, and instructs the channel establishment device 405 to establish a channel

5 between the mobile terminal 100 and equipment external to the wireless access network. Then, the channel establishment device 405 establishes a channel between the mobile terminal 100 and equipment external to the wireless access network, and transmits an IP packet containing the communications establishment request

10 signal from the mobile terminal 100 to a terminal external to the wireless access network. Furthermore, the channel control device 404 transmits to the wireless base station 200 a communications establishment permission signal for permission of the communications between the mobile terminal 100 and

15 equipment external to the wireless access network (step 540), and issues an instruction to establish a dedicated channel between the mobile terminal 100 and the wireless access gateway 400 in a wireless region.

Then, the wireless base station 200 establishes a dedicated

20 channel between the mobile terminal 100 and the wireless access gateway 400 in a wireless region. Thereafter, the mobile terminal 100 can communicate with a terminal external to the wireless access network through the dedicated channel (step 550).

If the wireless access gateway 400 determines when a

25 communications establishment request signal is transferred in step 500 that the source of the communications establishment request signal, that is, the mobile terminal 100, is permitted to communicate with equipment external to the wireless access

network, then it establishes a channel between the mobile terminal 100 and the equipment external to the wireless access network without changing the destination of the communications establishment request signal into the access network control 5 station 300, and transmits to a terminal external to the wireless access network an IP packet containing the communications establishment request signal from the mobile terminal 100.

(Second Embodiment)

FIG. 3 is a block diagram of the wireless access system 10 according to the second embodiment of the present invention.

As shown in FIG. 3, the wireless access gateway 400 in the wireless access system according to the second embodiment of the present invention comprises an intra-network signal transmission/reception device 411, a wireless common control signal transmission/reception device 412, a wireless signal transmission/reception device 413, a channel control device 414, 15 and a channel establishment device 415.

The intra-network signal transmission/reception device 411 transmits/receives a signal between the wireless base station 200 and the access network control station 300 in a wireless access network.

The wireless common control signal transmission/reception device 412 transmits/receives through the intra-network signal transmission/reception device 411 a wireless common control signal to be communicated through a shared control channel in 25 a wireless region. The shared control channel is used by the mobile terminal 100 not permitted to communicate with equipment

external to the wireless access network in communicating a wireless common control signal.

When the wireless common control signal transmission/reception device 412 receives a wireless common control signal from the mobile terminal 100, it changes the destination of the wireless common control signal into the access network control station 300, and transfers the wireless common control signal to the access network control station 300.

The wireless signal transmission/reception device 413 transmits/receives through the intra-network signal transmission/reception device 411 a wireless control signal communicated through a dedicated channel in a wireless region. The dedicated channel is used by the mobile terminal 100 permitted to communicate with equipment external to the wireless access network in communicating a wireless common control signal.

When the access network control station 300 permits the communications between the mobile terminal 100 and equipment external to the wireless access network, the channel control device 414 controls the establishment of a channel between the mobile terminal 100 and the equipment external to the wireless access network.

The channel establishment device 415 establishes a channel between the mobile terminal 100 and equipment external to the wireless access network under control of the channel control device 414.

The operations performed by the wireless access system shown in FIG. 3 in the communications from the mobile terminal 100

to a terminal external to the wireless access network are described below by referring to a flowchart shown in FIG. 4.

First, the mobile terminal 100 transmits a communications establishment request signal which is a wireless control signal

5 to the wireless base station 200, and the wireless base station 200 transfers the communications establishment request signal to the wireless access gateway 400 without conversion (step 600).

In the wireless access gateway 400, the communications establishment request signal from the mobile terminal 100 is

10 received by the wireless common control signal transmission/reception device 412 or the wireless signal transmission/reception device 413 through the intra-network signal transmission/reception device 411. When a communications establishment request signal from the mobile

15 terminal 100 is received by the wireless common control signal transmission/reception device 412, the wireless common control signal transmission/reception device 412 changes the destination of the communications establishment request signal into the access network control station 300 (step 610), and transfers

20 the communications establishment request signal to the access network control station 300 (step 620).

Then, the access network control station 300 continues communications through the wireless base station 200 with the mobile terminal 100 which is the source of the communications

25 establishment signal transferred from the wireless access gateway 400. In the communications, if a new IP layer technology has been developed, the IP layer technology is applied to a wireless access network.

Then, the access network control station 300 determines whether or not the communications between the mobile terminal 100 and equipment external to the wireless access network can be permitted based on the communications with the mobile terminal 100. When the communications with equipment external to the wireless access network are permitted, the access network control station 300 transmits a communications establishment permission signal to the wireless access gateway 400 (step 630).

In the wireless access gateway 400, the channel control device 414 receives a communications establishment permission signal from the access network control station 300, and instructs the channel establishment device 415 to establish a channel between the mobile terminal 100 and equipment external to the wireless access network. Then, the channel establishment device 415 establishes a channel between the mobile terminal 100 and equipment external to the wireless access network, and transmits an IP packet containing the communications establishment request signal from the mobile terminal 100 to a terminal external to the wireless access network. Furthermore, the channel control device 414 transmits to the wireless base station 200 a communications establishment permission signal for permission of communications between the mobile terminal 100 and equipment external to the wireless access network (step 640), and issues an instruction to establish a dedicated channel between the mobile terminal 100 and the wireless access gateway 400 in a wireless region.

Then, the wireless base station 200 establishes a dedicated channel between the mobile terminal 100 and the wireless access

gateway 400 in a wireless region. Afterwards, the mobile terminal 100 can communicate through the dedicated channel with a terminal external to the wireless access network (step 650).

When a communications establishment request signal is
5 transferred in step 600, and the communications establishment request signal is received by the wireless control signal transmission/reception device 413, the wireless access gateway 400 establishes a channel between the mobile terminal 100 and equipment external to the wireless access network without
10 changing the destination of the communications establishment request signal into the access network control station 300, and transmits to a terminal external to the wireless access network an IP packet containing the communications establishment request signal from the mobile terminal 100.

15 As describe above, in the present invention, a wireless base station transfers a wireless control signal from a mobile terminal to a wireless access gateway without conversion, and the wireless access gateway transfers the wireless control signal to an access network control station corresponding to a channel
20 used in the communications of the wireless control signal or by the source of the wireless control signal. Then, the access network control station determines whether or not the communications between a mobile terminal and equipment external to the wireless access network can be permitted by the
25 communications with the mobile terminal through the wireless base station. If the communications with the equipment external to the wireless access network is permitted, an instruction is issued to the wireless access gateway to establish a channel

between the mobile terminal and equipment external to the wireless access network.

Thus, since a new IP layer technology such as authentication, accounting, QoS control, etc. can be forcibly applied to a wireless access network in the communications with a mobile terminal in the access network control station, it is not necessary for a number of wireless base stations to add or amend the new IP layer technology to a wireless region specific signal.